

Attorney Docket No.: 130013/11921 (21635-0116)  
Application No.: 10/735,370

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### Remarks

This application has been reviewed in light of the Final Office Action of July 11, 2005. Claims 1-17 are pending. Claims 8 and 12 were previously cancelled, and claims 1-7, 9-11, and 13-17 are rejected. In response, the following remarks are submitted. Reconsideration of this application, as amended, is requested.

Claims 13-17 are rejected under 35 USC 102 over Subramanian US Patent 6,296,945. Applicant traverses this ground of rejection of the claims as amended.

The following principle of law applies to sec. 102 rejections. MPEP 2131 provides: "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. The identical invention must be shown in as complete detail as is contained in the ... claim. The elements must be arranged as required by the claim..." [citations omitted] This is in accord with the decisions of the courts. Anticipation under section 102 requires 'the presence in a single prior art disclosure of all elements of a claimed invention arranged as in that claim.' Carella v. Starlight Archery, 231 USPQ 644, 646 (Fed. Cir., 1986), quoting Panduit Corporation v. Dennison Manufacturing Corp., 227 USPQ 337, 350 (Fed. Cir., 1985).

Thus, identifying a single element of the claim, which is not disclosed in the reference, is sufficient to overcome a Sec. 102 rejection.

In the present approach, a cerium-oxide-precursor compound that is not itself cerium oxide with cerium in the +4 oxidation state is deposited on the surface of a primary thermal barrier coating material. The cerium-oxide-precursor compound is thereafter reacted to form cerium oxide with cerium in the +4 oxidation state. The present Specification explains the reasons for this approach and the improved results achieved using this approach, see for example para. [0011]-[0012], and [0029]-[0030].

Subramanian teaches quite a different approach. Subramanian deposits a compound that may be a cerium-containing compound of cerium and oxygen overlying an oxide thermal barrier coating material, and then reacts the cerium-containing compound with the thermal barrier coating material to make a more-complex oxide. Subramanian uses the term "precursor" to mean something very different from its use in the present claims. In the present application, the term "precursor" refers to a compound that reacts to form

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cerium oxide, while in Subramanian it refers to a cerium-oxygen compound that is reacted with another oxide to form a reaction product; thence the cerium-oxygen compound is a precursor to the reaction product.

Claim 13 recites in part:

"a sintering-inhibitor region at a surface of the primary ceramic coating, wherein the sintering-inhibitor region comprises cerium oxide with cerium in the +4 oxidation state in a concentration greater than a general cerium oxide concentration in the primary ceramic coating." [emphasis added]

Subramanian has no such disclosure. Subramanian does not disclose that the cerium is in the +4 oxidation state.

The explanation of the rejection in regard to now-cancelled claim 12 (Office Action of April 1, 2005, page 3, lines 1-3), which recited the +4 oxidation state, references col. 2, line 65-col. 3, line 10 and col. 5, lines 40-50 to support the rejection of the +4 oxidation state limitation. These portions of Subramanian make no reference to the oxidation state, and give no composition suggesting that cerium might be in the +4 oxidation state. Subramanian teaches  $C_zO_w$  compounds as precursors of another reaction, without ever defining z and w when  $C=Ce$ , not as the reaction product of a precursor compound of cerium oxide. Subramanian's reaction product is an oxide of A and C or B and C (col. 5 lines 44-45), without any suggestion that there might be cerium in the +4 oxidation state. The selection of the +4 oxidation state is not a matter of design choice, because Subramanian does not present any such design choice. All of Subramanian's discussion is in general terms, without setting forth specific compounds and valence states.

In the Response to Arguments in the paragraph bridging pages 8-9 of the Final Office Action, Examiner states that "Since Subramanian puts no limits on z and w, it would indicate that all possible numbers for z and w are present..." This position is contrary to law and to the MPEP as quoted above. MPEP 2131 provides: "The identical invention must be shown in as complete detail as is contained in the ... claim. The elements must be arranged as required by the claim..." The Examiner's argument is contrary to this provision of the MPEP. The inability of a prior art reference to define a particular compound may not be taken as evidence that the prior art has defined the particular compound.

In the explanation of the next-discussed rejection of claims 1-7, 9, and 11 over Subramanian in view of Ueda, there is the statement "Subramanian teaches all of the features of these claims except that (1) the application of a non cerium oxide precursor and

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heating to form cerium oxide in a +4 oxidation state..." Since claim 13 recites "sintering-inhibitor region comprises cerium oxide with cerium in the +4 oxidation state", Applicant understands this statement to be an admission that Subramanian does not disclose the quoted limitation of claim 13.

Applicant asks that the Examiner reconsider and withdraw this ground of rejection.

Claims 1-7, 9, and 11 are rejected under 35 USC 103 over Subramanian in view of Ueda US Patent 5,697,992. Applicant traverses this ground of rejection.

The following principle of law applies to all sec. 103 rejections. MPEP 2143.03 provides "To establish prima facie obviousness of a claimed invention, all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F2d 981, 180 USPQ 580 (CCPA 1974). All words in a claim must be considered in judging the patentability of that claim against the prior art. In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970)." [emphasis added] That is, to have any expectation of rejecting the claims over a single reference or a combination of references, each limitation must be taught somewhere in the applied prior art. If limitations are not found in any of the applied prior art, the rejection cannot stand. In this case, the single applied prior art reference clearly does not arguably teach some limitations of the claims.

Claim 1 recites in part:

"depositing a cerium-oxide-precursor compound onto an exposed surface of the primary ceramic coating, wherein the cerium-oxide-precursor compound is not cerium oxide with cerium in a +4 oxidation state, and

heating the cerium-oxide-precursor compound in an oxygen-containing atmosphere to form cerium oxide with cerium in the +4 oxidation state adjacent to the exposed surface of the primary ceramic coating." [emphasis added]

Claim 9 recites in part:

"infiltrating a cerium-oxide-precursor compound from an exposed surface of the primary ceramic coating into the primary ceramic

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coating, wherein the cerium-oxide-precursor compound is not cerium oxide with cerium in a +4 oxidation state, and

heating the cerium-oxide-precursor compound to form cerium oxide with cerium in the +4 oxidation state adjacent to the exposed surface of the primary ceramic coating." [emphasis added]

Subramanian teaches deposition of a compound that may be a cerium-containing compound of cerium and oxygen overlying an oxide thermal barrier coating material, and then reacts the cerium-containing compound with the thermal barrier coating material to make a more-complex oxide. Subramanian uses the term "precursor" to mean something very different from its use in the present claims. In the present application, the term refers to a compound that reacts to form cerium oxide, while in Subramanian it refers to a cerium-oxygen compound that is reacted with another oxide to form a reaction product; thence the cerium-oxygen compound is a precursor to the reaction product.

Thus, Subramanian has no teaching that the cerium-oxide-precursor compound is not cerium oxide with cerium in a +4 oxidation state, and that heating in an oxygen-containing atmosphere forms cerium oxide with cerium in the +4 oxidation state.

There is no teaching in Subramanian of producing cerium in the +4 oxidation state. The selection of the +4 oxidation state achieves important advantages as set forth in para. [0012] and [0030] of the present Specification. The selection of the +4 oxidation state is not a matter of design choice, because Subramanian does not present any such design choice. All of Subramanian's discussion is in general terms, without setting forth specific compounds and valence states.

Ueda teaches that a compound, which is not cerium oxide, may be converted to cerium oxide, specifically that ammonium cerium sulfate may be calcined to cerium oxide. That teaching has no relevance at all to the teachings of Subramanian. Subramanian never teaches converting something that is not cerium oxide to cerium oxide, but in fact starts with a cerium-oxygen compound of the form  $C_zO_w$ , without ever defining  $z$  and  $w$  when  $C=Ce$ , and then reacts the cerium-oxygen compound with another oxide to get a more-complex oxide reaction product. See for example col. 2, line 57-col. 3, line 25. Consequently, there is no motivation or objective basis for combining the teachings of these references.

The explanation of the rejection (page 7, line 9) and Response to Arguments (page 10, line 15) both assert that Ueda teaches the formation of " $CeO_2$ ", for example stating at page 10, lines 15-16 "As ammonium cerium sulfate is used and heated,  $CeO_2$  will be formed (providing Ce in the +4 oxidation state)." Applicant cannot find any mention of

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"CeO<sub>2</sub>" in Ueda, but instead has previously accepted the Examiner's representation that "CeO<sub>2</sub>" is formed.

However, Ueda does teach the composition of its cerium oxide, see col. 3, lines 2-5:

"The content of the cerium oxide in terms of Ce is about 5 to 25 parts by weight, preferably about 8 to 20 parts by weight per 100 parts by weight of the metal oxide."

This means that the cerium oxide of Ueda may range from Ce<sub>5</sub>O<sub>95</sub> (parts by weight) to Ce<sub>25</sub>O<sub>75</sub> (parts by weight). To convert to atom parts, each number must be divided by the atomic weight of the respective element, 140 for cerium and 16 for oxygen. Thus, the cerium oxide of Ueda may range from Ce<sub>5/140</sub>O<sub>95/16</sub> to Ce<sub>25/140</sub>O<sub>75/16</sub>, or Ce<sub>0.036</sub>O<sub>5.94</sub> to Ce<sub>0.179</sub>O<sub>4.68</sub> (parts atomic). Appendix A, attached, shows more detailed stoichiometry to calculate the atomic ratio of the 5 to 25 parts by weight taught by Ueda. Stated equivalently in a more conventional format with Ce = 1 to facilitate the comparison with the CeO<sub>2</sub> represented by Examiner, the cerium oxide taught by Ueda may range in composition from CeO<sub>166.7</sub> (parts atomic) to CeO<sub>26.25</sub> (parts atomic). This range does not encompass CeO<sub>2</sub>, or anything remotely close to it. Relying upon the statements of the explanation of the rejection and the Response to Arguments, consequently Ueda does not teach cerium in the +4 oxidation state. As a result, if the teachings of Ueda are combined with those of Subramanian in the manner urged by the rejection, the values of z and w in Subramanian must be chosen such that the cerium oxide ranges from CeO<sub>165</sub> to CeO<sub>26</sub>, not CeO<sub>2</sub>, with the result that the asserted combination of Subramanian and Ueda clearly does not teach a cerium oxide with Ce in the +4 oxidation state. Under this combination of teachings, it may certainly not be argued that the values of z and w in Subramanian may be selected so that z = Ce = 1 and w = O = 2.

Applicant asks that, if the rejection is maintained, the Examiner indicate the source of the assertion that Ueda teaches "CeO<sub>2</sub>" and Ce in the +4 oxidation state

Applicant asks that the Examiner reconsider and withdraw this ground of rejection.

Claim 10 is rejected under 35 USC 103 over Subramanian in view of Ueda, and further in view of Taylor US Patent 5,520,516. Applicant traverses this ground of rejection.

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Claim 10 depends from claim 9, and incorporates its limitations. The combination of Subramanian and Ueda does not teach these limitations for the reasons stated above, and which are incorporated here. Taylor adds nothing in this regard.

There is no objective basis for combining the teachings of Taylor with those of Subramanian and Ueda.

Applicant asks that the Examiner reconsider and withdraw this ground of rejection.

**CONCLUSION**

For at least the reasons set forth above, Applicant respectfully requests reconsideration of the Application and withdrawal of all outstanding objections and rejections. Applicant respectfully submits that the claims are not anticipated by, nor rendered obvious in view of the cited art, either alone or in combination, and thus, are in condition for allowance. As the claims are not anticipated by nor rendered obvious in view of the applied art, Applicant requests allowance of all pending claims in a timely manner. If the Examiner believes that prosecution of this Application could be expedited by a telephone conference, the Examiner is encouraged to contact the Applicant's undersigned representative.

This Response has been filed within three (3) months of the mailing date of the Final Office Action and it is believed that no fees are due with the filing of this paper. In the event that Applicant is mistaken in these calculations, the Commissioner is hereby authorized to deduct any fees determined by the Patent Office to be due from the undersigned's Deposit Account No. 50-1059.

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Respectfully submitted,

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## Appendix A

### Stoichiometry to calculate Ce to O atomic ratio as taught by Ueda

#### A. 5 parts Ce to 100 parts metal oxide by weight

$$\frac{n}{m} = \frac{5 \text{ pts. wt. Ce}}{100 \text{ pts wt. Ce}_n\text{O}_m} \times \frac{1 \text{ atom Ce}}{140 \text{ pts. wt. Ce}} \times \frac{140n + 16m \text{ pts wt. Ce}_n\text{O}_m}{1 \text{ atom Ce}_n\text{O}_m} \times \frac{1 \text{ atom Ce}_n\text{O}_m}{m \text{ atoms O}}$$

$$\frac{n}{m} = \frac{700n + 80m}{14,000m}$$

$$\frac{n}{m} = 0.5n/m + 0.0057$$

$$\frac{n}{m} = 0.06 \quad \text{OR} \quad \text{when } n=1, m = 166.7$$

#### B. 25 parts Ce to 100 parts metal oxide by weight

$$\frac{n}{m} = \frac{25 \text{ pts. wt. Ce}}{100 \text{ pts wt. Ce}_n\text{O}_m} \times \frac{1 \text{ atom Ce}}{140 \text{ pts. wt. Ce}} \times \frac{140n + 16m \text{ pts wt. Ce}_n\text{O}_m}{1 \text{ atom Ce}_n\text{O}_m} \times \frac{1 \text{ atom Ce}_n\text{O}_m}{m \text{ atoms O}}$$

$$\frac{n}{m} = \frac{3500n + 400m}{14000m}$$

$$\frac{n}{m} = 0.25n/m + 0.0286$$

$$\frac{n}{m} = 0.031 \quad \text{OR} \quad \text{when } n=1, m = 26.25$$